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Emergence in Theological Perspective: A Corollary to Professor Clayton's *Boyle Lecture*[1]

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It is highly apposite that Philip Clayton has chosen the topic of emergence for his Boyle Lecture 2006. Not only has our lecturer contributed substantially to the re-establishment of emergentism as a safe and challenging middle way between dualism and physicalist reductionism,[2] Clayton has also highlighted aspects of natural causation, which was already observed by Robert Boyle (1627–91), in whose name the Boyle Lectures are given. Being one of the founders of modern chemistry, Boyle was attentive to the appearance of novel qualities of material configurations and repeatedly emphasized what has later become known to us as whole-part-causation: ''For we must consider each body, not barely as it is in itself, an intire and distinct portion of matter, but as it is a part of the universe, and consequently placed among a great number and variety of other bodies, upon which it may act and by which it may be acted on in many ways....''[3] It is no coincidence, therefore, that the *Oxford English Dictionary of English* counts Boyle as one of the very first to use the term 'emergence.'[4]

From the clockwork to the network

Even though Robert Boyle was a firm proponent of a mechanical world-picture, 20th century scholarship has shown to what extent Robert Boyle's atomic theory of matter was dynamical in nature. No less a figure than the historian of science Thomas Kuhn pointed out how Boyle's ''dynamical atomism'' allowed him to understand the universe as self-transformative so that the universe eventually is, or rather becomes, what Boyle himself called a ''*self-moving machine*.''[5] Chemistry, for Boyle, was the study of mixed bodies above the level of the minimal corpuscles (the *minima*). Boyle here observed that even the *mixta prima* (like gold) were not stable, since primary compounds could also take part of new reaction cycles in other contexts. What matters, after all, are not only the components but also the constellations of matter. Here it is that both the term and the subject-matter of emergence enters into the picture: in clusters of particles, says Boyle, when the corpuscles lose their shape, size or motion, ''each of them really ceases to be a corpuscle of the same denomination it was before; and from the coalition of these *there may emerge a new body, as really one*, as either of the corpuscles was

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before they were mingled, or if you please, confounded.''[6] There might eventually be a shorter way from the clockwork picture of the universe that Boyle favored to the network view of the world of nature that 20th century emergentism has suggested to us.

But it should not be overlooked either, as rightly observed by Professor Clayton, that the style of theological reasoning has changed significantly since the time of the original *Boyle Lectures* between 1692 and 1732, initiated by Richard Bentley's famous *Confutation of Atheism*. After all, it is not atheism but the feasibility of an out-and-out reductionism that is refuted by the emergentist paradigm. It is indeed possible to fully accept the reality of qualitatively new and causally effective structures in the world of nature (i.e. to adopt strong emergence), without thereby embracing a broadly theistic account of our emergent universe. There is not, as perhaps hoped for by Robert Boyle, a clear inference from the world of nature to God, from the field of chemistry to the reality of a wise and caring creator. What one can claim, however, is that the emergentist view of nature is highly congenial with the a priori expectations that a believer in a creative and benevolent God would have of the structure of the world of nature. It can even be argued that the general thrust of evolution towards ever more complex forms of creatures—adaptive, sensitive and communicative creatures—can best be accounted for from a theistic perspective, as suggested by Clayton, especially if one is interested in a comprehensive explanation of reality rather than confining oneself to causal explanations of particulars. Therefore, what I would like to do here is to discuss, in sympathetic agreement with Professor Clayton's lecture, the importance of an emergentist worldview for religious reflection, in particular for Christian theology. Crudely said, is there a connection between the chemistry of emergence and the emergence of Jesus Christ? Put more modestly, and more to the point, what are the potential bearings of emergentism for a religious understanding of divine grace or generosity?

The natural abode of emergent phenomena

Let me nonetheless begin with a short reflection on the limits of the idea of emergence. Most concepts have a certain range of applicability, and this also applies to the idea of emergence. Emergent phenomena are ubiquitous in an evolving world, as rightly shown by Clayton, but emergent processes do not happen unexpectedly. Prior to the interesting cases of emergence, there is a physical universe that both affords and supports the appearance of qualitative novelty.

Emergent processes, almost by definition, means emerging from, or growing out of, something that is already established. It is not possible to imagine emergent processes arising without a *physical basis* from which they take off and without an *appropriate milieu* to sustain their development and flourishing. The fluidity of water does not happen without the prior existence of oxygen and hydrogen molecules, without the chemical bonding laws (which indeed can be reduced to physical properties) and without the appropriate temperature. Similarly, birds do

not flock without individual birds having the capacity to orient themselves in relation to one another, and without specific environmental factors such as temperature, aerodynamics, and other factors yet unknown to us.

These simple examples suffice to show that emergent properties do not rule out reductionist explanation, since emergent processes build on persistent physical and chemical structures that often have a nice and simple reductionist explanation. Accordingly, the paradigm of emergentism cannot, and should not, be used to weaken the quest for a reductionist causal analysis within physics, chemistry, and biology, wherever applicable. What the paradigm of emergence falsifies, if it is successful, is the claim of a thorough reductionism. Clayton rightly insists on the necessity of explanations that take into account holistic features of evolving systems. He also points to the importance of co-evolution as a prime facilitator of new emergent phenomena, such as the co-evolution of the brain and language. Emergentist explanations here always rest upon reductionist explanations, but the emergentist paradigm is able to explain more, in so far as it addresses the specific configurations or patterns in which new properties emerge and new processes are propagated, often with startling causal effects. Emergentist explanations here explain more than could be explained from the perspective of microphysical determination, or from the perspective of a genes-alone view within biology.[7]

Designed for emergence?

These observations also have some relevance for theology. For if emergent processes are always arising on the basis of certain persistent background conditions of a physical-chemical sort, and if emergent processes are always conditioned by complex boundary conditions, theology should refrain from contrasting self-organization and emergence on the one hand and the possibility of design arguments on the other hand. It is possible to argue that the world of nature is exactly designed for self-organization. At the very least, what we observe from our own vantage point is that the physical world is a particularly fertile milieu for emergent phenomena.[8]

Note, however, that this theological design argument only relates to the basic constituents of matter, and to laws of nature reigning at the constituent level of physics. The so-called Anthropic Principle asks what the relations are between fundamental physics and the emergence of life on planet Earth (and perhaps elsewhere in the universe). One here wonders: ''Why is it that we have the kind of matter we have (with a propensity for life), and why is it that we have laws of physics which seem fine-tuned for the emergence and propagation of life.'' In addition to this meta-scientific question we can, as argued by the South African cosmologist George Ellis, explore a correlative set of scientific questions: ''How much could the initial conditions of the universe differ from what they actually are, and how much could the fundamental laws of physics be different, and we would still have the emergence of life?'' Since all life, that we know about is carbon-based, and the route to the formation of carbon is highly contingent on the

size of the universe (since carbon is formed in stars with the rare triple-alpha reactions), the design hypothesis remains a strong candidate for truth. For sure, we do not have a clear inference from laws of nature to design; but we do have a plausible truth-candidate, which is fully as rational as competing explanations in terms of ultimate chance (the Lady Luck-hypothesis) or the metaphysical hypothesis of multiverses.[9] Moreover, a higher-order hypothesis of a divine design would be at least compatible with a notion of radical contingency, or with the putative existence of multiverses, even though the design hypothesis would then lose its rational superiority over against its rival explanations.[10]

Against this background, I would therefore argue that self-organization no less than emergence can replace the explanatory function of the design argument concerning the world's *basic framework*. At this level, we might still follow Robert Boyle's intellectual confession, ''I ascribe to the wisdom of God . . . the first fabric of the universe . . .''[11] Far from being a formal argument of design, Boyle here makes a practical inference, sitting on the stool of wonder while observing the high degree of coordination within the physical cosmos.

Where emergence comes in, and design fails

Now, as Clayton reminds us, design arguments *concerning specific biological systems* have indeed become obsolete after Darwin's theory of evolution. In today's science, self-organization and natural selection do the job that earlier could only be explained by appeals to special divine designs.[12] The American Intelligent Design Movement (ID) is, therefore, bound to fail, first because it speaks as if it were possible to ''detect design'' from the appearance of ''irreducible complexity'' (a move which most design theorists find unconvincing);[13] second because it uses gaps of current science to fill in God (or other designers); and third because it fails to acknowledge the extent to which the processes of evolution use pre-adapted structures for building up new structures for other adaptive purposes.[14] I would also argue that ID is theologically flawed for the simple reason that it presupposes a fundamental contrast between the workings of nature, and God's work as creator.

I will therefore leave ID as it is and instead follow up upon Clayton's observation that emergence is closely linked to co-evolution. As is well known, the idea of emergence came up in the safe climate of evolutionary thinking, as epitomized in the British biologist C. Lloyd Morgan's *Emergent Evolution* (1923).[15] What still needs to be clarified in theoretical biology, however, is the relation between the many cases of self-organization and emergence on the one hand, and natural selection on the other hand. Is emergence the well-spring of a host of new hopeful evolutionary candidates, which drive evolution, though always constrained by natural selection that determines which organisms have a future, and which not? Or is it the other way around: that natural selection drives the course of evolution, though always constrained by what is physically feasible? As argued by David J Depew and Bruce H. Weber in *Darwinism Evolving* these issues remain controversial within current biology.[16] I find it most likely that one could find

empirical cases for both alternatives.[17] If so, this is a further plank in the argument for strong emergence, as laid out by Clayton and others. For whether emergent processes are mainly creative by feeding the game of selection with new hopeful creatures, or by constraining the process of selection, emergent processes must be accorded a strong status of being ''real,'' since they have long-range causal effects in evolution.

Admittedly, in some cases of emergence, such as in the case of snowflakes, one could argue that such constellations of matter, rich and diverse as they are, have no bearing for the future. However, this would not be the case where emergent processes are coupled with evolutionary stable structures that have a capacity not only to replicate themselves but also to store information for later use. As soon as memory comes into the play in evolution, learning also appears, and a new level of emergence has been reached.[18] In particular, this is the case for self-productive or autopoietic systems that, once they have emerged, develop by utilizing their own stored information systems. We find this new level perhaps at the level of cells but at least at the level of immune systems that are self-selective in the process of producing anti-bodies. Even more so do brains with associated consciousness and human languages develop by autopoiesis, or self-prductivity.

From emergent properties to emergent persons

Up to this point, I have sometimes spoken about emergent properties, sometimes about emergent processes. The difference may indeed be crucial, for mere emergent properties do not necessarily have causal effects, unless they are part of emergent processes of a physical nature. One example is the emergent *qualia* of consciousness such as our perception of colors. It is in principle a thinkable hypothesis, laid out some years ago by David Chalmers in *The Conscious Mind*, that human consciousness may be accorded a kind of reality status, since the first-person perspective is a novel feature of the universe in addition to physical descriptions of the universe, including ourselves, from a third-person perspective. According to Chalmers, however, consciousness does not play any causal role; there may just be a flow of consciousness running in us alongside our physiological brain states. Consciousness and brain states are correlated *ad hoc*, but according to Chalmers the current state of neuroscience cannot deal with the ''hard problem'' of consciousness: ''Why is it that we at all have states of consciousness?'' Chalmers' proposal is then, first, that we should face the hard problem of consciousness (not pretending to have solved the problem of consciousness by pointing to *ad hoc*-correlations between neuronal and psychological states). Second, that human consciousness plays no causal role in our behavior; and third, that we may imagine a future science that will uncover the fundamental psycho-physical laws that may really explain consciousness.[19] The fundamental problem with Chalmers' intelligent thought experiment, as I see it, is not only that he denies that brains actually cause consciousness (though perhaps not conclusively), but also that he understands consciousness to make up a separate world of its own, a secluded world of consciousness. Re-phrased in

Clayton's terms, Chalmers fails to realize that the emergent properties (or ''naturally supervenient'' states) of consciousness are features of biological agents, which for sure *are* real-world physical organisms and *do* have causal effects. In short, the emergent properties of consciousness are not free-floating, but reside in emergent processes of a physiological nature.

The question is here, ''What is it that emerges?'' If it is only *properties* that emerge, we may have only weak emergence, that is, emergence without particularly novel causal powers. Water and snowflakes may be of this sort, as consciousness is, on Chalmer's account. However, if it is *processes* that emerge, the emergent structures are part of the causal nexus that channels and selects between physical options, such as in the case of digestive systems, where the structure of the stomach decides the sorts of nutrition to absorb or expel. Finally, if biological *organisms* or *self-reflexive agents* emerge during evolution, it is (Chalmers' thought experiment notwithstanding) hardly possible to deny that emergent organisms exert a specific causal influence on their future.[20] Even if it could be shown that a sudden flickering brain state in a gander triggers the migration of geese, neither the leading role of the gander, nor the flocking behavior of the geese, nor the goal-oriented behavior of migration, say from Denmark to Greenland, could be explained apart from the social patterns of learning and behavior which have evolved over centuries in such specific geese populations. We do not call it a ''migration pattern'' merely as a nice shorthand for properties ''in reality'' governed by physical processes, nor do we understand the minds of birds as a secluded world of its own. If we disregard the emergent level of learning behavior at the level of bird populations, we simply cannot give a causal account of so many kilos of physical stuff moving from Denmark to Svalbard, and to Greenland.

In addition, much more so with human consciousness. We are indeed, as noted by Clayton, continuous with both our biological past and our contemporary mammalian cousins. Yet we are also discontinuous. For human cultures, presuppose the co-evolution of *type-different systems*, such as language (a cultural system) and brains (a physiological system). As bio-cultural creatures, human beings are able to produce new domains of creativity, such as complex human societies, in which agents are able to deliberate and make informed choices about *what* to do, *how* to do it, *with whom* to do it, and *where* to go. Human beings live in their constrained natural habitats but also in an open horizon of developmental possibilities to be explored.

The kind of language utilized by human beings is therefore unique in relation to our mammalian peers. As argued by Terrence Deacon, our language is symbolic in nature, in principle distinct from the signal language that we find among other mammals.[21] What we refer to in our languages are not only specific particulars, like warning signals referring to specific sorts of predators; we refer also to abstract realities such as ''animals,'' ''country,'' ''money'' or ''love,'' where only in the process of communication do we specify, what we are referring to, while retaining an open horizon of meaning. The expression ''my love'' can thus refer to my wife, my child, my dog, my own love, or to divine love, all dependent on the particular context. By using universals, we are also able to anticipate and respond to potential states that are not yet made into reality. This we do routinely in

planning activities, and we do it religiously when we attune ourselves to spiritual realities, which are yet in the process of coming. ''The time is fulfilled, and the kingdom has come near, repent, and believe in the good news.'' (Mark 1:14) This saying of Jesus, the first saying reported in Gospel of Mark, addresses human beings as whole persons, as agents in their own lives, as responsible for their community, and as persons that are to attune themselves to the reality of the kingdom of God (which only exists as a spiritual possibility). Human beings not only live in a fixed physical environment, but in a symbolic world that comprises both that which is seen and that which is yet unseen.

God as subject-and-verb

Now, how far can the idea of emergence be used in our language about God? It seems to me that here again, we come to a limit in the use of the concept of emergence in theology. I concur with Clayton that one should not expect too direct a connection between emergent patterns in nature and our concept of God. If we were to follow Samuel Alexander's understanding of the world process as a ''deisising'' process, God would be the product, even a victim, of the cosmic process. The distinctive character of God, as also expressed by Alexander, would then be ''lodged in only a portion of the Universe,'' since the ''distinctive character of deity is not creative, but created.''[22]

Put in grammatical terms: in the theistic traditions, both in India and in the Abrahamic traditions, God always takes the position of the logical subject, that is, the position of firstness, while a radical emergentist view of God places God in the position of the predicate, that is, as the secondary one, while the material universe would take the logical place of the subject. God would not be a reality ontologically prior to the world, but the subsequent result of the world process, in so far as the predicates of goodness and beauty are realized (they are not everywhere). One could then speak of ''the divine'' (the predicate), but not about God (the subject). This was also the position that Ludwig Feuerbach took in his atheist critique of Christianity in *The Essence of Christianity* (1844). Here Feuerback famously asked, ''Who is actually our redeemer and reconciler? Is it God, or is it Love? It is Love! For it is not God that has redeemed us but Love, which so loftily transcends the difference between divine and human personality.''[23]

By contrast, theistic traditions understand God as the eternal and everlasting *source of emergence*. This fits with my earlier view that the world may be explained as a fertile abode created by God for the purpose of self-organization and emergence. In this view, God's priority is retained. Then one might wonder: does this mean that God the Creator stays aloof from the world, without any connection to the world of creation other than that of being its designer and initiator? In fact, this view can be found in Christian tradition, especially in the tradition of natural theology. Here I would like to suggest that the idea of emergence might prompt us to take leave of *fabricator model* of the creator that has been part of standard philosophical theism. Rather, we should assume a more *artistic model* of God being the artist, while the world of nature expresses of God's

eternal Light, Love, and Beauty. In this picture, there is no divide—and hence no competition—between God's creative activity and natural creativity, for the latter is exactly the expression of the former.

Put in grammatical terms, God should not be conceived of as a solitary subject standing above creation, but as the unity of the grammatical position of the subject-clause and the verb: That which makes things happen. The emerging reality of the world of creation, then, takes the logical role of the predicate, always initiated by God (''The Father''), expressing God's Logos (''The Son'') and being enabled and embraced by God (''The Spirit'').

What needs to be added to this classic formulation of God's ubiquity, however, is a new emphasis of God playing not only the role of the active agent, but also that of the receiver.[24] This may be termed a ''temporal theism,'' that is, an understanding of God as having both an eternal nature—as the everlasting Light, Love, and Beauty—and a relation to time and the emergence of novelty. For the God who genuinely loves the world also needs to understand the world and to feel the world from the inside, from the first-person perspective of animal and human existence. In order for God's Love to be accomplished, God must be empathetic and compassionate, yet without being dragged down by suffering.[25]

The point of departure for such a temporal theism is in Christianity the central idea of incarnation. However, if a temporal God is not to be a victim of the world's suffering, the principle of divine firstness must be retained. As earlier, this puts constraints to the theological use of the idea of emergence. Accordingly, classic Christianity asserts that it is from the inner nature of God's triune life that the divine will to create and be part of creation arises. This is expressed in the notion of divine *kenosis*, by which I here mean God's self-determination to be part of creation, and to take on the role of the creature, that is, *also* the logical position of the predicate. However, in order not to be dragged down by the world's suffering, Orthodox Christianity also affirms that only the eternal Son or Logos of God ''became flesh.'' (John 1:14) By contrast, God, the heavenly Father, stands for the everlastingly active pole in God, while the Holy Spirit in God's triune life stands for the constant perichoresis between Father and Son, including the interpenetration of the eternal nature of God and the flux of emergence and breakdown of which the divine Logos takes part.

Jesus as emergent reality

This view of the God-world relation derives from the Christian interpretation of the human person Jesus as Christ, as ''the image of the invisible God, the firstborn of all creation.'' (Col 1:15.) However, the New Testament sources are complex, as we know. We both find passages that describe Jesus as a fully human being and as eternal Lord. In Paul we hear that Jesus was ''born by a woman, born under the law'' (Gal 4:4) and similarly the gospel narratives depict Jesus as a child of the history of the human religion; he is told to have entered the temple as a young boy and was found by his parents ''sitting among the teachers, listening to them and asking them questions.'' (Luke 2:46.) Yet, we hear the well-known stories of his

wonderful birth: Jesus was conceived by the Holy Spirit and the power of the Most High overshadowed Mary, his mother (Luke 1:34–35); likewise we hear about the extraordinary authority of Jesus, and that he could say to his followers: ''These words you hear are not my own; they belong to the father who sent me.'' (John 14:24.)

Theologians have sometimes been divided on this issue. Should we choose the more human formulations (as liberals tend to prefer), or should we choose the more emphatic divine explanations of who Jesus really was (as conservatives argue)? Since the 1960s, theological discussions on Christology have being plagued by such easy contrasts between ''Christologies from below'' and ''Christologies from above.''

Where would a theology informed by emergentism place its priorities? A first option is that an emergentist Christology simply uses the concept of emergence and re-applies it to the particular historical figure of Jesus. Thus one might say that Jesus is a new reality, emerging within the realm of a specific human civilization, which itself has emerged from an animal heritage, which again has evolved from the basic structure of life that once upon a time, some 4.5 billion years ago, arose from inorganic matter. In effect, this would be an extended version of a Christology from below.

On reflection, however, this solution is hardly advisable. For again we need to remind ourselves about the endemic limits of the concept of emergence. For as we saw above, emergent processes, by definition, grow out of something already existing. As a matter of fact, emergent phenomena *always* need an appropriate milieu in order to emerge. Taking the concept of emergence seriously means taking seriously also the preconditions of emergent phenomena. What I want to argue here is that what is the case in natural phenomena is also, by analogy, the case in the human person of Jesus as Christ. Just as features of consciousness do not flow unsupported by brains, and just as brains do not emerge apart from a suitable biological organism, and just as biological organisms do not arise apart from a physical world of regularities and basic physical laws, so Jesus cannot be said to be the expression of God's embracing love without God (one way or another) pre-existing as a divine milieu of love. Accordingly, one should not prematurely establish a contrast between an emergentist Christology ''from below'' and an incarnational Logos-Christology ''from above.'' Rather, a more self-reflexive version of an emergentist Christology might want to argue that in the radically contingent life-story of Jesus, and in his poignant parables, it is exactly the eternal life-story of God that was expressed, re-enacted or revealed, in the Jesus-story.

As is well known, the old Church decided at the Council of Chalcedon 451 to stay with the conundrum: Jesus is ''truly God and truly human.'' Furthermore, it was said that Jesus ''is to be acknowledged in two natures, without confusion, without change, without division, and without separation.'' This so-called two-natures doctrine may not be very helpful as a description of ''two natures'' in the one person of Jesus.[26] Nevertheless, the fundamental view that the genuine human form of Christ is indistinguishable from the genuine divine expression in Jesus seems inescapable from a logical point of view. What emerged in the teaching of Jesus, and in his behavior towards his neighbors, is, as perceived from

Christian belief, exactly the expression of the mind of God from the beginning. A religious novelty, which emerged out of history and was lived out in the midst of creation, was God's *Logos* (''Mind''), *Sophia* (''Wisdom''), or *Eikon* (''Image'') from old. Jesus not only spoke about God, but he *was* the realization of God's Word to humankind. Jesus not only referred to divine wisdom, but he *was* God's Wisdom in person. Jesus not only spoke about the Kingdom of God as a new emerging reality, but he initiated the Kingdom around him and included human beings in the reign of God.

In all these strands of scripture there is here no hint of a competition between Jesus the Son of Man on earth and his heavenly Father. For the conviction of the first Christians was, as Christians believe today, that Jesus at once was the *re-enactment* of a divine purpose from old, and a *radical novelty* that broke with tradition (while still using the reservoirs of religious wisdom, wherever fitful for his purpose). The life history of Jesus was both seen as a new emergent reality, and as an expression of the eternal Mind of God.

Conclusion

What I have proposed is that the idea of emergence loses its meaning if it is applied in a too indiscriminate way. In the world of nature, emergent processes take place in a physical and chemical setting, which is a friendly and supportive abode for emergent processes to thrive. There must be an orderly and regular world in order for novelty to take place, and there must exist highly fine-tuned laws of nature in order for biological evolution to take place. In theology, similarly, emergence should not be used as the key to all sorts of theological questions. Following the cues of Professor Clayton, I have attempted to show that a Christian theology of creation and incarnation is particularly pre-adapted for absorbing important elements of the emergentist paradigm. In a temporal theism, there are temporally emerging aspects even within God's everlasting nature, and in the doctrine of incarnation the humanity of Jesus is affirmed as an emergent reality who was tapping both from the reservoir of religious traditions and from the until then untapped resources of the emerging reality of the reign of God.

The common denominator between the doctrine of creation and Christology, as proposed in this lecture, lies in the complex unity of creator and creature, of the truly human and the truly divine. Just as the divine and the human cannot be separated, nor should be confused, according to the Chalcedonian paradigm, so the naturalness of creation should be affirmed as the prime expression of the beauty and benevolence of God.

Endnotes

1 What follows is a response to Philip Clayton's *Boyle Lecture* 2006. The lecture and response were given for a general audience at the Church of St Mary-le-Bow, Cheapside, London on 22 February 2006, where also the original Boyle Lectures were delivered 1692 – 1732. I am grateful to Michael Byrne for discussions of an earlier draft to this paper.

2 Philip Clayton, *Mind & Emergence: From Quantum to Consciousness* (New York: Oxford University Press, 2004). Philip Clayton and Paul Davies, eds. *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion* (Oxford: Oxford University Press, 2006).
3 Robert Boyle, *The Works of the Honourable Robert Boyle*, ed. T. Birch (London: Millar, 1744), vol. II, 464.
4 *Oxford English Dictionary* (Oxford: Oxford University Press, 1989), vol. 5, 175–176.
5 Boyle, *The Works of the Honourable Robert Boyle*, vol. II, 474 (Italics Boyle's). See Thomas Kuhn, ''Robert Boyle and Structural Chemistry of the Seventeenth Century,'' *Isis* 43:1 (1952): 17.
6 Boyle, *The Works of the Honourable Robert Boyle*, vol. III, 88 (Italics mine). Quoted from Kuhn, *op. cit*, 26.
7 See, e.g. Jason C. Jenson, ''Innateness, Developmental Systems and Explanation,'' onegoodmove.org/1gm/1gmarchive/ooo494.htlm, December 2002 (accessed February 14, 2006).
8 Niels Henrik Gregersen, ''From Anthropic Design to Self-Organized Complexity,'' in *From Complexity to Life: On the Emergence of Life and Meaning*, ed. Gregersen (New York: Oxford University Press, 2003), 206–234.
9 George F. R. Ellis, ''The Theology of the Anthropic Principle,'' in *Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine Action*, eds. Robert J. Russell, Nancey Murphy, and C. J. Isham (Vatican City: Vatican Observatory Publications/Berkeley, Calif.: CTNS, 1993), 367–406.
10 Robert John Russell, ''Cosmology, Creation, and Contingency,'' in *Cosmos as Creation: Theology and Science in Consonance*, ed. Ted Peters (Nashville: Abingdon Press, 1989), 196–204.
11 Boyle, *The Works of the Honourable Robert Boyle*, vol. V, 163.
12 A helpful historical overview is offered by Michael Ruse, *Darwin and Design: Does Evolution have a Purpose?* (Cambridge, Mass.: Harvard University Press, 2003).
13 Richard Swinburne and Alvin Plantinga, just to mention two prominent design theorists, who have not been convinced that ID-proponents have redeemed their high promises.
14 A very concise critique of Michael Behe's claims is presented by the biologist Kenneth R. Miller, ''The Flagellum Unspun: The Collapse of 'Irreducible Complexity,''' in *Debating Design: From Darwin to DNA*, eds. William A. Dembski and Michael Ruse (Cambridge: Cambridge University Press, 2004), 81–97. Concerning the wider perspectives relating to emergence and self-organization, see Bruce H. Weber and David J. Depew, ''Darwinism, Design and Complex Systems Dynamics,'' in *Debating Design*, eds. Dembski and Ruse, 173–190.
15 C. Lloyd Morgan, *Emergent Evolution* (London: Williams and Northgate, 1923).
16 David J. Depew and Bruce H. Weber, *Darwinism Evolving: Systems Dynamics and the Genealogy of Natural Selection* (Cambridge, Mass.: MIT Press, 1995), 479–490.
17 Niels Henrik Gregersen, ''The Complexification of Nature: Supplementing the Neo-Darwinian Paradigm?,'' *Theology and Science*, vol. 4, no. 1 (2006): 16–19.
18 See Bruce H. Weber and David J. Depew, eds., *Evolution and Learning: The Baldwin Effect Reconsidered* (Cambridge: Mass.: MIT Press, 2003), especially Terrence W. Deacon, ''The Hierarchical Logic of Emergence: Untangling the Interdependence of Evolution and Self-Organization,'' 273–308.
19 David J. Chalmers, *The Conscious Mind: In Search of a Fundamental Theory* (New York: Oxford University Press, 1996). It should be noted that Chalmers resists being labelled a standard epiphenomenalist; he nonetheless argues that ''experience (is) explanatorily irrelevant. We can give explanations of behaviour in purely physical or computational terms, terms that neither involve nor imply phenomenology'' (Ibid., 156). Furthermore, processes of natural selection ''cannot distinguish between the effects of my consciousness and an hypothetical zombie twin placed in the same physical situation''

(Ibid., 120). The former conclusion is the one that I am going to question, following the emergentist argument. Interestingly, Chalmers has very recently conceded the plausibility of the thesis that ''there is exactly one clear case of a strongly emergent phenomenon, and that is the phenomenon of consciousness,'' ''Strong and Weak Emergence,'' in *The Re-Emergence of Emergence*, eds. Clayton and Davies, 244–254, here 246, see no. 1. However, Chalmers here distinguishes between strong emergence as ''a strongly emergent quality'' (what usually is termed weak emergence with the only exception that it cannot be deduced from physical laws, as we know them) and potential cases of ''strong downward causation.'' Chalmers still does not find downward causation in consciousness (Ibid., 249), unless quantum mechanics could be shown to offer the fundamental psycho-physical laws, as argued by, e.g. Henry Stapp. A forceful criticism of Chalmers' original theory is presented by John R. Searle, ''Consciousness & the Philosophers,'' *The New York Review* (6 March 1997): 43–49.

20 I have discussed the status of the emergents in more detail in ''Emergence and Complexity,'' to be published in *The Oxford Handbook in Science and Religion*, ed. Philip Clayton (New York: Oxford University Press, 2006), 767–783.

21 Terence W. Deacon, *The Symbolic Species: The Co-Evolution of Language and the Brain* (New York: W. W. Norton, 1997), 69–101.

22 Samuel Alexander, *Space, Time, and Deity* (New York: The Humanitarian Press, 1920), vol. I, 357 and 397.

23 Ludwig Feuerbach, *Das Wesen des Christentums* (Stuttgart: Reclam, 1984), 106–107. Translation mine.

24 In discussion with five theological models I have argued so in ''Emergence: What Is at Stake for Religious Reflection,'' in *The Re-Emergence of Emergence*, eds. Clayton and Davies, 279-303, no. 1.

25 This is the view of creation that has been especially emphasized in Orthodox, Lutheran and Anglican traditions, since these traditions in particular the ubiquity (''every-whereness'') of God's human presence in creation. Conc. the Anglican tradition, see Arthur Peacocke, ''Nature as Sacrament,'' in *Vision or Revision: Seeing through the Sacraments*, ed. Jeremy Morris (London: Affirming Catholicism, 2000), 16–31; for the Lutheran tradition, see Niels Henrik Gregersen, ''Unio Creatoris et Creaturae: Martin Luther's Trinitarian View of Creation,'' in *Cracks in the Wall: Essays on Spirituality, Ecumenicity and Ethics*, eds. Else Marie Wiberg Pedersen and Johannes Nissen, (Frankfurt am Main: Peter Lang, 2005), 43–58.

26 The blind alleys of the two-natures doctrine have been analyzed sharply by Wolfhart Pannenberg, *Jesus—God and Man* (Philadelphia: Westminster, 1968), chap. 8, yet without giving up the basic motivation behind the *vere deus, vere homo.*

Biographical Notes

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